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# THE PHYSIOLOGICAL BASIS OF EDUCATIONAL THEORY.

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(*Continued from page* 582.)

## PART II.

(1.) THE NEURON. The complexity of this marvellous system is somewhat simplified to the understanding by the fact that it is composed of a multitude of units built on the same ground plan, a plan which is a microscopic type of the whole. The "neuron" or nerve element is a single club-shaped cell of protoplasm, from one side of which proceed short tufts of grey matter (dendrons), and from the other one or more compound nerve fibres, each made up of many exceedingly delicate fibrils.*

The fibrils which make up the fibre or nerve-axis of the unit neuron (axis-cylinder or axon) seem to originate in the sensitive tufts (dendrons) and pass through the cell body (Max Schultze), which probably serves them with nourishment. They are conductors of the nerve current, the dendrons conveying irritation towards the cell, while the sheathed nerve

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* This has been revealed by the fact that although the differences of structure between the parts of the neuron are too slight to be seen with the microscope, nevertheless they have different affinities for chemicals. Professor Golgi, of Pavia, found (1885) that treatment with chromate and osmic acid, followed by silver nitrate, brought out with surprising clearness the intimate structure of the cells of the cortex, and showed that their fibres, instead of forming a felted mass of nerves touching one another, are not in permanent contact. There is a gap between neighbouring neurons of, it may be no more than $\frac{1}{10000}$ of an inch, but they are separated by other matter of different affinities, whose function is not yet clearly defined. "Meynert, Max Schultze, R. Wagner, Kölliker, Gowers, Weigert, Bevan Lewis, Golgi, Ramon y Cajal, Nissl, Flechsig and others" have "revealed paths of conduction between the outer world and the regions of highest cerebral functions, between hemisphere and hemisphere, between convolution and convolution, and between the tracts of the special organs of sense." (Address of Sir John B. Tuke, Pres. R.C.P., Edin., *Lancet*, August 6th, 1898.)

fibres convey current from it to the next neuron. "Neurons of the brain and spinal cord transmit nerve impulses to each other, and nerve currents are sent through other neurons to the arms and legs, to different muscles of the face, to the heart, to the blood vessels and to different other cells of the brain itself," and out of all these but a very small portion reach our consciousness.* When the impulse runs from the skin to a ganglion which has motor connections independent of the brain, reflex action follows; if the connections are both to the brain and to voluntary (striated) muscle by a motor nerve, there will be both reflex and conscious action; if in addition the ganglion is connected to the vaso-motor system, that set of ganglia which is connected with the heart, intestines and other internal organs, these also may participate in the disturbance, and we may turn pale, shed tears and so on. The brain cells which receive the sensory current are stimulated, and "thoughts" are started. The paths which the nerve-impulse follows and the activity which it starts in a number of cells of the brain, the spinal cord and the ganglia are hypotheses no more. . . . . . And when the anatomist maintains that an irritation of the skin will be transmitted in this way and not in another, to such cells in such cases, and start into activity such cells of the brain, this is speculation no longer. It is a fact of natural science, firmly established and verified in different ways by a mass of mutually controlled observations."

While the brain was thought to consist of a mass of neurons in contact, there was no satisfactory explanation why an impulse spreading in such a mass of neurons should excite definite lines of activity and arouse certain associations only. By the discovery that the ends of the fibres (axons) are not in permanent contact, a new light has been thrown on the processes of thought. As the nerves pass on their current in the brain by definite paths in each case, awakening one set of associations only, it is clear that there must be some mode of making and breaking contact between neighbouring neurons. Different thoughts imply different lines of contact. Three hypotheses are in the field, of which that of Professor Ramon y Cajal is, perhaps, the best supported, and agrees best with the observations of Widersheim on the living neurons in the brain of a little crustacean (Leptodora hyalina), which has so transparent a body and skin that its brain can be observed in full activity. The cells "are endowed with a wonderful mobility. Like the little amœbas they change their forms, protrude ramifications and draw them in. And the proof that the little brain was working in its own crustacean way whilst Widersheim observed it, was that its cells exhibited the same symptoms of fatigue which Dr. Hodge discovered in the nerve-cells of the higher animals, their contents became troubled and the same vacuoles appeared in their protoplasm."

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* Hence the study of psychic changes by internal perception alone must always be quite illusory.

It would appear therefore that the fibres of the grey cortex are association-pathways along which the nerve current produces consciousness and thought. And the development of these pathways is visibly a gradual process, just as we know by experience that their use is gradually acquired. In the infant brain the dendrons and fibres are but imperfectly developed, whereas in the adult they form a network of cells and fibres. It is evident that whether the arrangement of these pathways is orderly or otherwise must depend largely on mental experiences. It is even probable that each cell and sheathed fibre, and each fibril, in these has its own particular function, regulated by the circumstances under which it came into being and the purposes for which it has been used. Dr. Fothergill remarks that the fact that a man who has lost his arm will still localise impressions in his fingers proves that in addition to those large psycho-motor centres with which we are familiar, there must further be much smaller tracts appropriated to the impressions coming from and the impulses going to small muscles and organs: and this agrees with the fact that the distinction of particular tracts in the brain is accompanied not only with the loss of particular sensations, but of particular memories also. Weariness of particular cells by exhaustion of their powers deprives them temporarily of function, and this explains how words and thoughts once familiar escape the over-wrought brain. Nor is this complexity surprising when we reflect that some 600,000,000 of these cells are reckoned in the cortex, which would allow fifty for each minute of a long life to receive separate impressions. (Dr. Wilks.)

In the aged, where brain failure has been marked in life, the brain cells again present the appearances of infancy—they have lost their processes. "In the very senile period, say at seventy-five and eighty, the cell body appears granular and has fewer processes as prepared by the Bevan Lewis method; as prepared by the Nissl method, its chromatic granules are disposed differently; and as prepared by the Golgi method, its dendrites and their gemmules are changed, and many of them have undergone atrophy or bulbous swellings. The actual number of neurons in any given field of the microscope is fewer than in youth, just as is seen in brain sections from dements" (T. S. Clouston, F.R.C.S.E.) Of course none of these facts makes man an automaton. The connection of the life which builds this wonderful mechanism from the primitive neuron (para. 2) is as profoundly mysterious as the mode by which the will uses this same mechanism. And the great facts remain that not only is it true that the higher self can by orderly thought and mental and bodily self-control make the association-pathways orderly, durable and healthy, but even that "it seems certain that the simple direction of consciousness to a part, independently of emotional excitement, but with the expectation that some change will take place in its organic activity, is often sufficient to induce such an alteration; and would probably always do so if the concentration of the attention were sufficient" (Dr. W. B. Carpenter, F.R.S.) This sentence is one of those which illuminate a wide field, for the "direction of the consciousness" being the direction of the nerve-current which is the means of growth and change, it becomes possible that processes of development and healing may both be strongly affected by the action of the mind, if indeed it do not ultimately appear that the direction of this nerve current is the mode in which local remedial and educative agencies principally act.*

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* The preceding paragraphs are an outline of the work of specialists. Acknowledgments are due to J. Milner Fothergill, M.D. (*Diseases of Sedentary and Advanced Life*); to Prince Kropotkin, *Nineteenth Century*, July 1897; to Dr. T. S. Clouston, F R.C.S.E. (Address: Psychology, Brit. Med. Ass., Edinburgh, July, 1898); to Sir John Batty Tuke, M.D. (Address: Psychologica Medicine, Brit. Med. Ass., Edinburgh, 1898), reported in the *Lancet* and *British Medical Journal* of that month; to Michael Foster's *Text-book of Physiology*; to Prof. Luys, Phys. La Salpétriere (*Brain and its Function*.)

(2.) The Economy of Nervous Energy. However complex the functions and intricate the paths of the nerve currents, in one thing they are alike. Each and all are transformations of power, the nervous "flow" is a flow of energy just as much as is the electric current to which it offers some curious resemblances. That is to say, it must correspond to quite definite amounts of the purely physical energy contained in foods, and it is with this energy that nutrition is principally concerned, the amount of matter food daily yields to the system being small while the energy it parts with is large. It is this energy, invisible and imponderable, but capable of very definite measurement in other ways, which is the driving force of the animal mechanism, and, directed by a wisdom transcending our experience and our imagination alike, builds up the human bodily structure. But however directed, this flow of power is itself purely physical, and follows physical laws—it is dissipated just as all other power is dissipated, in heat, and renewed by fresh supplies. The exercise of a particular limb or organ is effected by increased nerve current, fatigue results from the using up of tissue, the products of such consumption being removed by the blood and eliminated from it by special organs such as the liver, which are set into activity by their special nerve flow, while afterwards the local irritation caused by the waste determines (through the vaso-motor nerves) the extra blood supply which is to repair that waste during the hours of rest. Thus the cycle of local nutrition is completed, and this is equally true when the waste is nervous and not muscular, as in brain work.

The nervous "flow" is, in short, the prime mover in the bodily changes of growth, secretion, exercise, and thought, which make up the phenomena of life. Each of these uses up the energy given to it, leaving correspondingly less for other functions. Overworked children cannot grow, and overgrown children cannot work up to normal standards. Insufficiency of this current of energy is the cause of "overstrain," and medical opinion is daily becoming more pronounced that defect in its quantity and quality is the common factor in many diseases. Thus Dr. Tyrell (*Nervous Exhaustion*, second edition, 1893,) writes:—"We are, I think, far too apt to undervalue the influence of exhausted states of the nervous constitution in the production of disease, and to elevate what are merely symptoms of nervous failure into the unmerited position of diseases—to recognize and treat effects as though they were causes; just as, with the causes themselves, we are apt to class those which are merely the exciting, as predisposing or ultimate causes. For instance, we talk of a neuralgia being due to cold or exposure, passing by entirely the condition of nervous exhaustion on which the disease is really founded and without which it could not possibly have arisen."

Insufficient nerve power is first manifest as a susceptibility to slight changes of cold, damp, bodily or mental stress, or noxious influences of any kind. Lowered nervous vitality reduces the power of resistance to such influences and they react on the sources of nutrition, impairing digestion and cutting off the supply of power at its source, till complete rest—the diversion of the entire fund of nervous energy to nerve restoration is imperatively demanded. This is the cycle of malnutrition, with which far too many of us are practically acquainted.

This diminished power of resistance to slight causes of disturbance is not only apparent in us but in our little ones also, and here, after a long but necessary anatomical digression, we return to the children. Their susceptibility to colds, headaches, indigestion and other ailments is, as has before been observed, markedly increasing, and more pronounced forms of nervous instability are not uncommon.

This fact, taken together with the increased demands of modern life, brings us face to face with the real educational problem. THERE IS OVERSTRAIN AND THERE MUST BE A HIGH STANDARD—HOW CAN THE FORMER BE AVOIDED WHILE THE LATTER IS MAINTAINED?

The educational problem therefore has become primarily one of the economy and the direction of energy, for this energy is not only the driving power of the human mechanism, but, governing the expenditure, it also indirectly determines the recuperation, and therefore the growth also, for growth is mainly the restoration of expended tissue. Cases of pronounced nervous instability demand, of course, special treatment directed to setting up that cycle of exercise, nutrition and rest which constitutes health. As soon as this has been established healthy development has begun, and normal process will then fortify the whole constitution in due time. The same principles govern the cases of children who readily "catch cold" or show susceptibility to ailments generally; the trouble is not effectively dealt with by guarding them from all changes of temperature or by special dietary, neither by mother's "coddling" nor father's "hardening," which I have known to produce disastrous results, but by a regimen under which nutrition, exercise, and sleep, are duly balanced, according to the powers and needs of the child, and the line which separates healthy weariness from exhaustion is never overstepped. And where the mind is kept braced and the faculties alive by exercises and interests within its powers, exactly the same healthy happy tone is observable in mental as in bodily exercises, and, making a little allowance for the "deal o' human natur' in man," as willing attention to work as to play.

But these interests require time to develop and actual contact with things themselves, with Nature in her many moods, with the common objects of the lanes and the shore, with simple mechanical models, with practical problems of number, space and form, with actual literature and with the raw material of history, not with dry descriptions of these things in words necessarily ill-understood. Interest is very very rarely excited in verbal descriptions of things, painfully learned and soon forgotten; indeed, so rarely is this the case that few teachers will believe that children will take a genuine interest in their work at all till about fourteen or fifteen years of age, and the program advocated by me has been thought to involve the very overstrain which it was planned to avoid, and which in practice is avoided by its use, because it answers to interests which are readily and easily awakened. It is conceded that the standard on which it is framed is not higher than is now needed for a liberal education on modern lines, but it is thought to be inapplicable to the age at which the course is to begin.

(3.) RATE OF GROWTH. If a given amount of work has to be done under easier conditions, the only possibilities are either to begin it earlier, or to do it by improved methods, or both. I hope to show that both of these are applicable to the problem. Parents naturally resist the suggestion to begin serious work at eight years old, because they think that it means the application to young children of the same process of cram which loss of time so often forces upon the later years, not perceiving that it may be the means of avoiding that cram altogether. It is objected that the early years should be spent in physical growth to prepare for the strain which is thought to be inevitable later.

But, as a matter of fact, the eighth and next following years are by no means those of most rapid growth in the life-history of the normal child. Annexed are the tabulated data from the works of the highest English authorities on the subject. Dr. Stephenson's results are from the statistics of height and weight of English-speaking races only, between the ages of five and eighteen years, and they are here supplemented by Dr. Roberts' figures for earlier and later periods and for chest girth, and by a few further figures from other recognized authorities. The careful study of these curves brings out some very interesting facts.

A diagram can easily be drawn from the subjoined figures, spacing vertically in years from birth to maturity, and the vertical distance of each point (indicated by a little circle) from its datum line along each of these vertical lines gives the normal height in inches of a boy of the age referred to. Taking first the curve A. It will be noticed that during the first year growth is very rapid—from $19\frac{7}{10}$ inches at birth to $28\frac{5}{10}$ inches at one year old. Thereafter it is nearly uniform to the seventh year, when it falls off (probably on account of the second dentition), after which it increases by not quite 2 inches a year up to twelve years old, when growth of 2 inches and over lasts up to seventeen, rapidly decreasing after this age.

The curve B, which gives in the same manner the increase in weight, shows that the average birth-weight of $7\frac{6}{10}$ lbs. doubles (15 lbs.) in the first year. Before the end of the fourth year the weight has again doubled (30 lbs.), but thereafter the growth is slow and regular, not reaching 60 lbs. till the ninth year (five years later), after which it is slow till the twelfth year, when it rapidly increases, reaching 120 lbs. at sixteen years of age. The intervals of doubling are therefore one, two-and-a-half, five-and-a-half, and seven years; there being also a marked periodicity in this increase, the fourth and ninth years showing a falling off, and the thirteenth and succeeding years a decided quickening.

The curve C, of chest girth, is somewhat less regular. A very rapid increase during the first year is followed by almost complete rest, and thereafter by an annual increase (with some slight oscillations) of about one inch up to the eighth year, when slow growth of about half-an-inch annually continues till the twelfth year, after which rapid increase sets in up to the seventeenth.

The results of both these curves have been combined in curves D and E. The former, curve D, is obtained by combining the height with the weight. If the growth be judged by neither height alone, nor by weight alone, but by both combined, its regularity from the second to the twelfth year is very remarkable, and its rhythmic character, as indicated by the slight drop about the third, eighth and twelfth years, is very interesting. But the main fact is unmistakeable, that rapid growth in height and weight ceases about the second year until the twelfth, when it begins again and lasts about four years.

If the general increase in massiveness be judged of by compounding height with chest girth, the curve E confirms the last results, showing an early growth of great rapidity, followed by slow steady progress up to the twelfth year (with again a marked pause at eight), and a rapid development from twelve to seventeen years of age.

It may, however, be objected that though the rate of increase is fairly regular in these years, that the tax on the nervous energy involved in putting on an increment of $2\frac{5}{10}$ inches of height, $4\frac{3}{10}$ lbs. of weight and $\frac{4}{10}$ inches of chest girth at six years, when the whole mass of the body is but $44\frac{8}{10}$ lbs., involves much greater effort to it than equal amount in later years when the whole machine is so much larger.

To test how far this objection is valid the following table has been calculated :—

| Year of Age. | SUCCESSIVE TOTALS OF | | | INCREMENT IN EACH YEAR. | | | RATIO OF INCREMENT TO LAST YEAR'S TOTAL. | | |
|---|---|---|---|---|---|---|---|---|---|
| | Height. **A.** | Weight. **B.** | Chest Girth **C.** | Height. | Weight. | Chest Girth. | Height. | Weight | Chest Girth. |
| | inches. | lbs. | inches. | | | | | | |
| Birth | 19·7 | 7·5 | 13·2 | | | | | | |
| 1 | 28·5 | 15·0 | 17·2 | 8·8 | 7·5 | 4·0 | ·45 | 1.00 | ·30 |
| 2 | 31·6 | 24·75 | 17·5 | 3·1 | 9·75 | 0·3 | ·11 | ·65 | ·27 |
| 3 | 35 | 28·80 | 18·6 | **3·4** | 4·05 | 1·1 | ·10 | ·16 | ·06 |
| 4 | 38·5 | 35·00 | 19·7 | 2·5 | **6·20** | 1·1 | ·07 | ·21 | ·05 |
| 5 | 41·3 | 40·49 | 21·2 | 2·8 | 5·49 | **1·5** | ·07 | ·16 | ·07 |
| 6 | 43·8 | 44·79 | 21·6 | 2·5 | 4·30 | 0·4 | ·06 | ·11 | ·01 |
| 7 | 45·8 | 49·39 | 22·2 | 2·0 | 4·60 | 0·6 | ·04 | ·10 | ·02 |
| 8 | 47·4 | 54·41 | 22·6 | 1·6 | 5·02 | 0·4 | ·03 | ·10 | ·01 |
| 9 | 49·7 | 59·82 | 23·2 | **2·3** | 5·41 | 0·6 | ·05 | ·10 | ·02 |
| 10 | 51·7 | 66·40 | 23·7 | 2·0 | **6·58** | 0·5 | ·05 | ·11 | ·03 |
| 11 | 53·5 | 71·09 | 24·3 | 1·8 | 4·69 | **0·8** | ·03 | ·07 | ·02 |
| 12 | 55 | 76·81 | 24·8 | 1·5 | 5·72 | 0·5 | ·02 | ·08 | ·06 |
| 13 | 57 | 83·75 | 26·3 | 2·0 | 6·94 | 1·5 | ·04 | ·09 | ·07 |
| 14 | 59·6 | 93·48 | 28·2 | 2·6 | 9·73 | 1·9 | ·04 | ·12 | ·05 |
| 15 | 62·3 | 104·90 | 29·7 | **2·7** | 11·42 | 1·5 | ·04 | ·12 | ·04 |
| 16 | 64·7 | 120·00 | 31·2 | 2·4 | **15·10** | 1·5 | ·03 | ·14 | ·05 |
| 17 | 66·2 | 129·19 | 32·8 | 1·5 | 9·19 | **1·6** | ·02 | ·08 | ·04 |
| 18 | 66·5 | 134·97 | 34 | 0·3 | 5·78 | 1·2 | ·04 | ·04 | ·02 |
| 19 | — | — | 34·7 | — | — | 0·7 | — | — | ·01 |
| 20 | — | — | 35·0 | — | — | 0·3 | — | — | ·01 |
| 21 | — | — | 35·3 | — | — | 0·3 | — | — | ·01 |

The first three columns give the exact figures, which curves A, B and C reproduce graphically; the second three give the increments of height, weight and girth in successive years; and the third set gives the fractions which these increments are of the total height, weight, or girth of the preceding year. Admitting for the moment that the whole mass of the body is concerned in the conversion of energy for growth, it will be seen from this table that the numbers which represent a high ratio of growth end about the sixth year, after which the child adds about $\frac{4}{100}$ths of its height, $\frac{1}{10}$th of its weight and $\frac{4}{100}$ths of its chest girth yearly—only two years (puberty) showing any marked deviation.

But it is not certain that the size of the growing body has much to do with the balance of energy available for growth, for increase of size brings with it increase of daily expenditure, and if it should be proved that the chief transformation of physical power into nervous energy depends rather upon the mass of the brain and the amount of food assimilated, then the twin facts—that the brain has attained nearly its full size by the seventh year, and the large appetite of a healthy child—would show that the source of what may be called organic energy is then in full activity.

(4.) “Nerve Signs.” There is, therefore, no ground whatever for saying that a boy shall “be growing” between his seventh and thirteenth years. Of course he should, but we “grow by doing” in mind and body; act, think, and be conformed to our surroundings we must, whether we will or no; the only question is, how shall we act and think, whether in disciplined order or in wayward and haphazard fashion. Healthy function of mind as well as of body is the best means of healthy growth, and this is a natural and pleasant process, for physical pain is primarily a warning of misdirected activity. The weariness which exhausts follows on quite short spells of distasteful and unsuitable work, while much heavier tasks which are congenial can be cheerfully and happily fulfilled and are followed by the sense of triumph over difficulty and increased power, which is the true test of mental progress.

Nor are we left without a guide to learn our errors in treatment by irremediable results. Not only is it true that well-fed Board School children of seven to eleven show only good results from the intellectual discipline of school life which many middle-class parents dread for their children of the same age who must be called on to face much severer intellectual stress, but we have also in the physical expression of the child an excellent guide to a sound judgment on our methods of dealing with him. Physical expression is defined as “the outward indication of some inherent property or function.” It is, in fact, the outward indications of the quantity and quality of the nervous flow, of how it has been directed in the past, and is being directed in the present.

Dr. Warner distinguishes two classes of expression—the fixed or immobile, which indicates the general conditions of heredity and past surroundings whose results make up the child's life history, and the changing or mobile expression, which is the reflect of the comparatively rapid changes going on from day to day, or at the moment. Thus the stature, weight, proportions, complexion, texture of the hair, colour and distance apart of the eyes, formation of the ears, shape of nose, mouth and palate, the size and shape

of the head, and the permanent acuteness or dulness of the senses, are all of them particulars of the fixed expression, and all being built up by the nerve-force, indicate its general amount and trend from year to year. They will all doubtless receive much fuller interpretation than has yet been given by the physiologist, but meanwhile they reveal matters to be taken into account by the schoolmaster as a guide to what may or may not be reasonably expected in particular cases where any of them may be more or less abnormal.

It is, however, with the changing or mobile expression that he is most concerned, for this is the danger-signal which is hung out as a warning either to stop or to follow another track, but which is (I speak from experience) frequently or even generally disregarded. I have seen a class of young children whose fidgetiness after two hours' continuous lessons revealed a nervous tension which made further learning for the moment impossible, and the attempt to teach a pernicious waste of time, punished in the name of “discipline” for their inability, with the result of turning their whole energy to the task of keeping quiet, the lesson being quite unheard. I have often seen well-meaning teachers endeavouring to compel a boy, already suffering from exhaustion, to give “more care and attention” by means of impositions, having the effect of dulling his brain still further. Canon Farrar has shown in an excellent little tale of school life*—which still, I gladly see, retains its popularity—one way in which a young boy may become a sloven and a dullard under the eyes of cultured and conscientious but quite unobservant masters, and I have seen in two large public schools among boys between twelve and sixteen, at a low estimate, some 30 per cent. showing the dulled complexion, indirect gaze, arrested development and slouching gait, which indicate pronounced nervous misdirection, without the masters having their attention aroused to the obvious inference that there must be some cause at work to produce these results.

The amount of energy daily supplied to a child in regular health and nutrition being a fairly constant quantity, and being normally used up between growth, exercise, and head work, an overdraft upon it must naturally be manifest somewhere.

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* St. Winifred's.

Now as the "tone" of the body depends on the steady supply of healthy nervous energy, one of the first effects of overdraft upon its reserves is that this muscular tone is relaxed; not uniformly, but according to the kind of exhaustion. For instance, the head held persistently to one side indicates weakness of the opposite side; if thrown backwards, that the brain is irritated or over-stimulated. Restless eyes indicate some form of nervous irritability, the exact cause of which will probably be revealed by closer observation. Other indications of irregular discharge of nervous energy are fretfulness or "nervousness" (often the first sign of something wrong), twitches, frequent blinking, spasmodic movements of one kind or another; while nervous exhaustion is shown by certain postures of the hand balance, and by the red and relaxed ears and the wrinkled brow, which are so frequently to be seen at the end of a school term. These are common signs of temporary overstrain on the way to become permanent, and may be due to very various causes to be determined specially for each special case. In young children (7—10), too long hours, enforced quiet, over-study, digestive troubles due to bolting food, are the usual causes. Among older boys, irregular demands on the secretory system or stimulus of certain nerve centres at critical periods of development must be borne in mind as additional possibilities. Relaxed muscle round the eyes and bending forward at the loins, lounging attitudes in walking, indicate malnutrition, whether from defective supply of food, want of assimilative power, disordered digestion, or vicious courses. The scale of food supply in schools for the children of the upper middle class may be assumed to be good and sufficient, but nevertheless cases of distinct malnutrition may often be seen, certainly arising from the frequent eating of sweets and "tuck" at odd hours to the neglect of regular meals, a matter which some mothers habitually encourage.

All the states above described are caused by defective or misdirected nervous flow, and if the conditions which produce them are prolonged, this tends to become permanent. Where they exist, tests of the acuteness of the senses will reveal that these are dulled, and though sights and sounds may fall upon the eyes and ears of the exhausted, ill-nourished or congenitally defective child, he does not effectively see or hear. He is, in fact, more or less advanced towards the

torpor of the quails, which, after the excessive demands of their flight across the Mediterranean on their nervous power, land on the coast unable to see or hear, and may be taken with the hand. It is probable that a very considerable amount of apparent intellectual difference is really difference in quickness of sensory reaction. If ideas are presented too fast none are completely formed, and therefore none can be remembered. Therefore no course can be more cruelly futile than the attempt to teach, to press, or to stimulate tired children. Far more progress is made in four hours of full alertness than in seven hours of constrained attention; and each of the changes of expression should be as an open book, wherein the teacher may read with running eye the conditions of his little ones, and be sure when inattention deserves rebuke or punishment, when it is the result of physical causes, when it is the proof that his methods are ill-adapted to the average of his class, or when individual weakness demands special treatment. I have no hesitation in saying that a health report, giving in simple form the actual facts, without any opinions on them, should be sent to parents, together with those interesting documents in which the personal equation of the form master bulks so largely; they would be welcomed by those parents who set fact above opinion, and desire to have reliable data for their watchfulness and for a forecast for the future of their sons.

But whether or not this course would be welcome to the average British parent, it is certain that such observations are most valuable to the master who wishes to do the best, not merely for his school *en bloc*, but for his boys singly, and desires to base his educational work on some surer foundation than that journeyman's "experience," which is so constantly appealed to, in happy disregard of failures, in vindication of the most opposite practices. This "experience" is, at its best, necessarily the more or less limited, if not actually biassed, conclusions of one member of a profession which we must sorrowfully admit to be, on account of its temptations to autocracy, perhaps the most narrowing in the world; and at its worst the arrogant disregard of all the carefully tested and exactly worded experience of qualified observers which is scientific knowledge.